

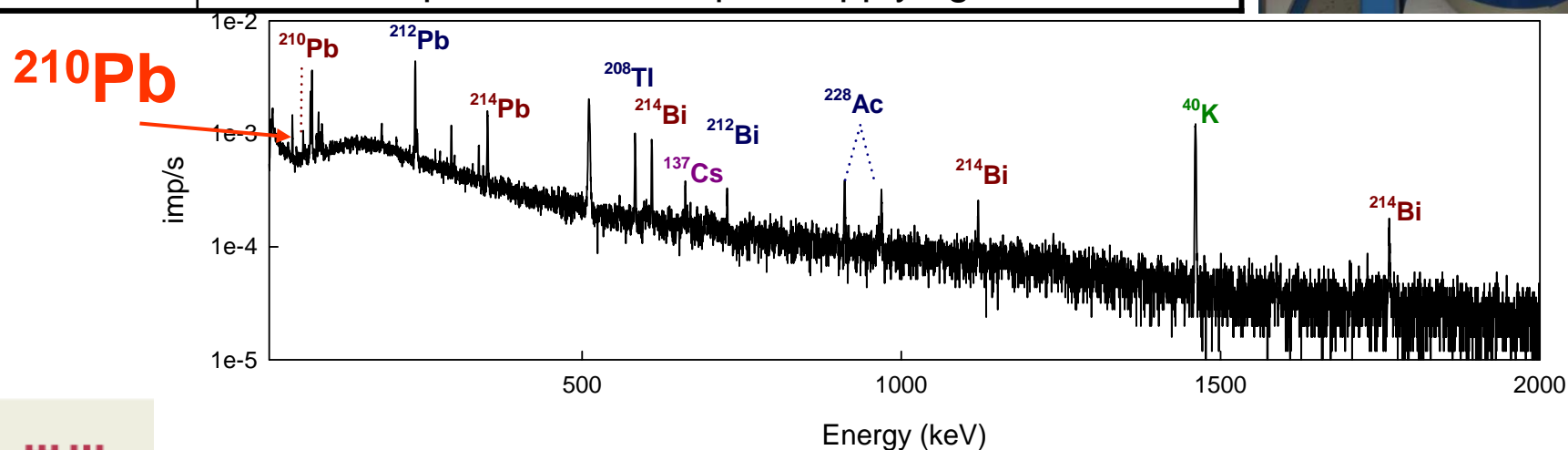
Gamma spectroscopy for chronology of recent sediments

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Let me introduce myself

- **Geologist**: Geophysics, Geochemistry and Geology of Mineral deposits, Charles University in Prague
- **Gamma (and alpha) spectrometrists**: Radioactivity measurements laboratory, University of Bremen: Radioactivity surveillance program IMIS
- **Tutor**: Environmental radioactivity, Measurement techniques and Practicals in Physics
- **PhD candidate**: Institute of Environmental Physics, University of Bremen – interdisciplinary project Sediment chronology

Pros	<ul style="list-style-type: none">• non-destructive• several isotopes measured simultaneously in one spectrum• only physical preparation of the samples, no time consuming chemical separation• efficiency is only dependent on physical parameters
Cons	<ul style="list-style-type: none">• need of large amount of sample (minimum 1 g d.m., optimum 50 g d.m.)• high background• efficiency varies with gamma energy• self-absorption in the sample – applying corrections



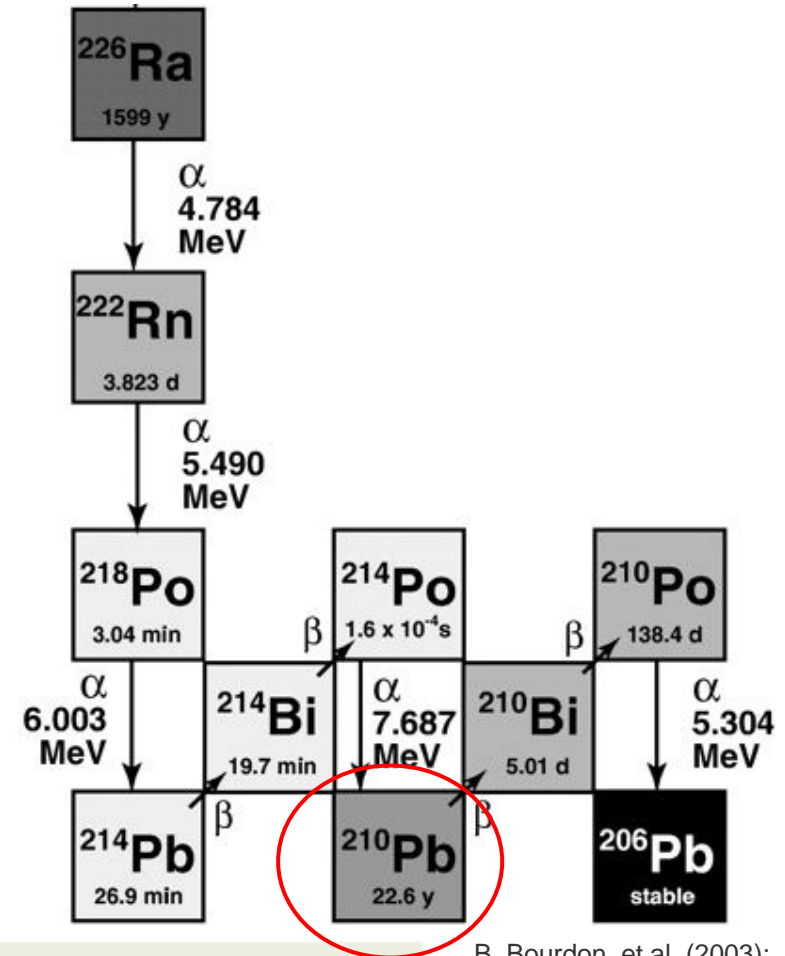
Gamma emitters in marine and lacustrine sediments

- U/Th decay series: ^{210}Pb , ^{226}Ra , ^{234}Th , ^{228}Th , ^{228}Ra (^{228}Ac)
- Primordial: ^{40}K
- Cosmogenic: ^7Be
- Artificial: ^{137}Cs , ^{241}Am

- They can be used for dating sediment sequences or tracing changes in recent parts of sediment cores (up to 150 years old)

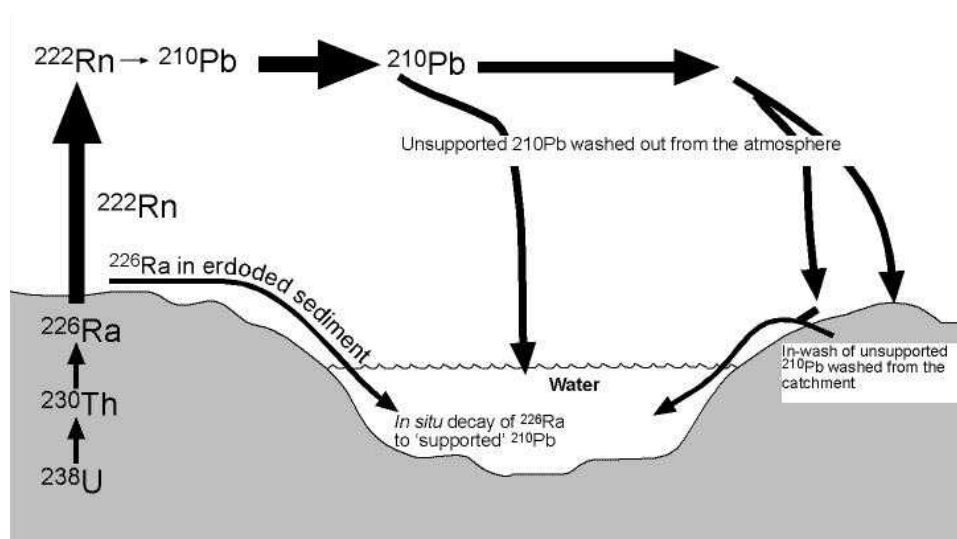
Radiotracer: ^{210}Pb

- Part of ^{238}U series
- Half-life 22 years – relative dating of ages between 20-150 years
- Sedimentation rates in lakes, estuaries and marine sediments – environmental studies, pollution, climate change, ...
- Peat bogs accumulation rates

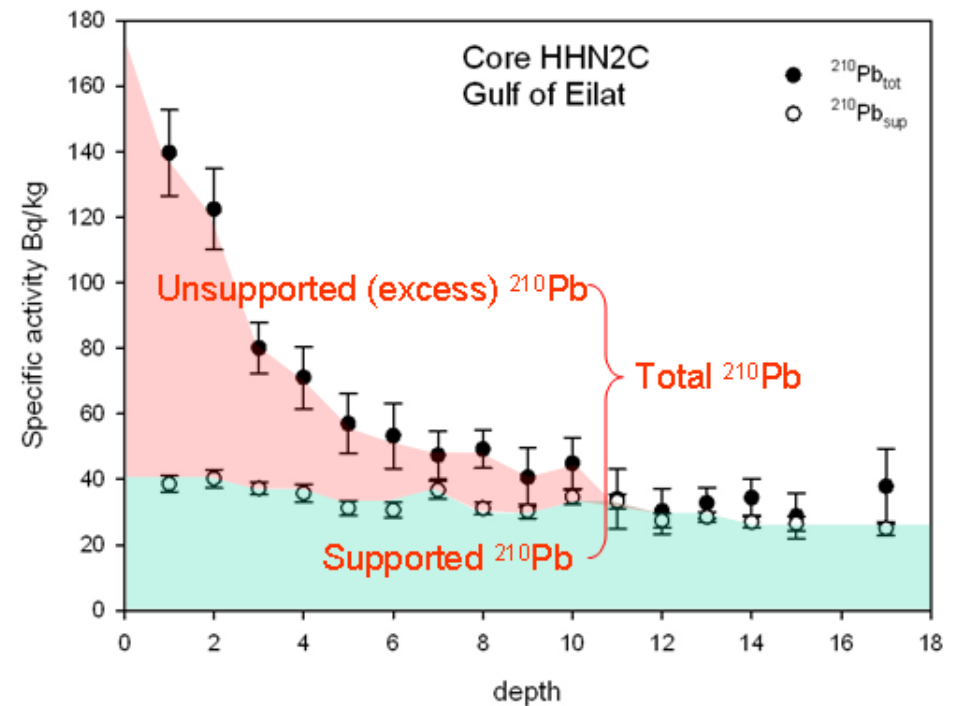


B. Bourdon, et al. (2003):
Reviews in Mineralogy and
Geochemistry 2003 52: 1-21.

Pathways of ^{210}Pb in aquatic sediments



(After Oldfield, F., Appleby, P.G., 1984).



- **Supported $^{210}\text{Pb}_{\text{sup}}$:** in situ from ^{226}Ra decay in sediment
- **Unsupported (excess) $^{210}\text{Pb}_{\text{xs}}$:**
 - dry or wet deposition of ^{210}Pb generated by ^{222}Rn decay in the air or
 - by ^{222}Rn decay in water column

Radiotracer: ^{137}Cs

- Artificial radionuclide introduced to the atmosphere by nuclear bomb-tests, nuclear accidents – Chernobyl - and other discharges from nuclear installations
- Half-life 30 years
- Often used as a independent chronometer for the last 60 years
- Onset round 1950, maximum 1963, 1986 Chernobyl peak in Europe

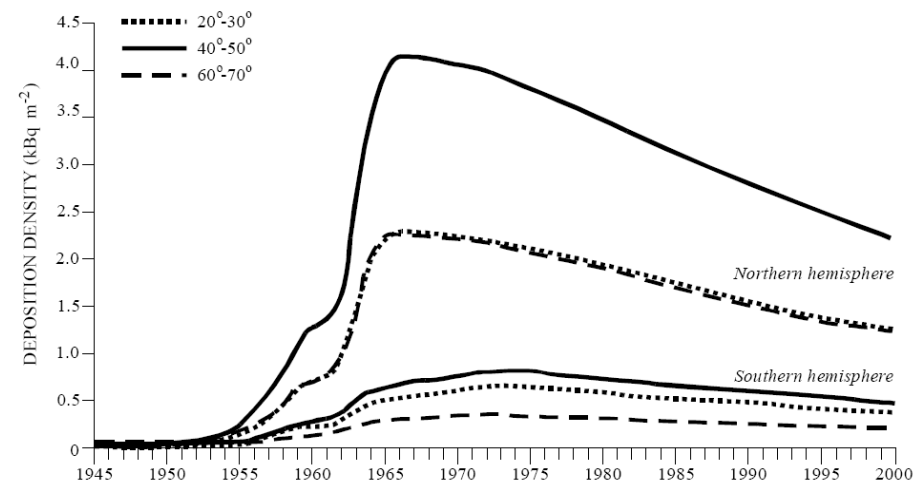


Figure VII. Caesium-137 deposition density in the northern and southern hemispheres calculated from fission production amounts with the atmospheric model.



Sahel zone climate change in the late Holocene



Multicorer

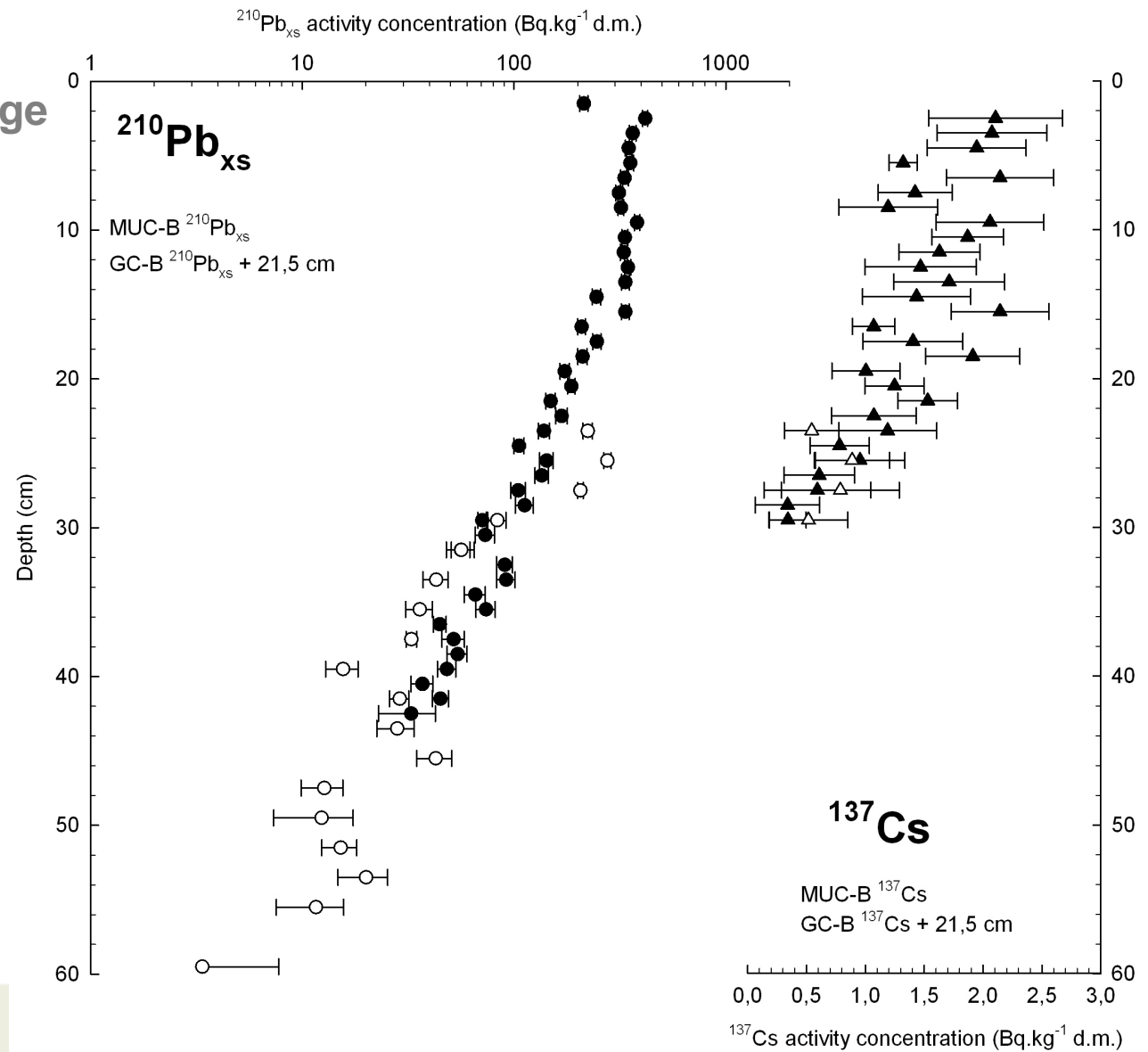
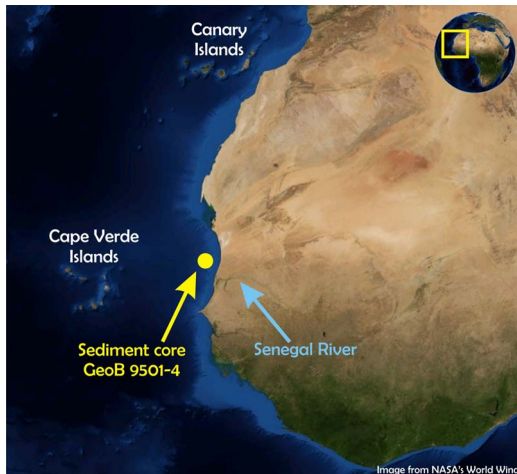


Gravity corer



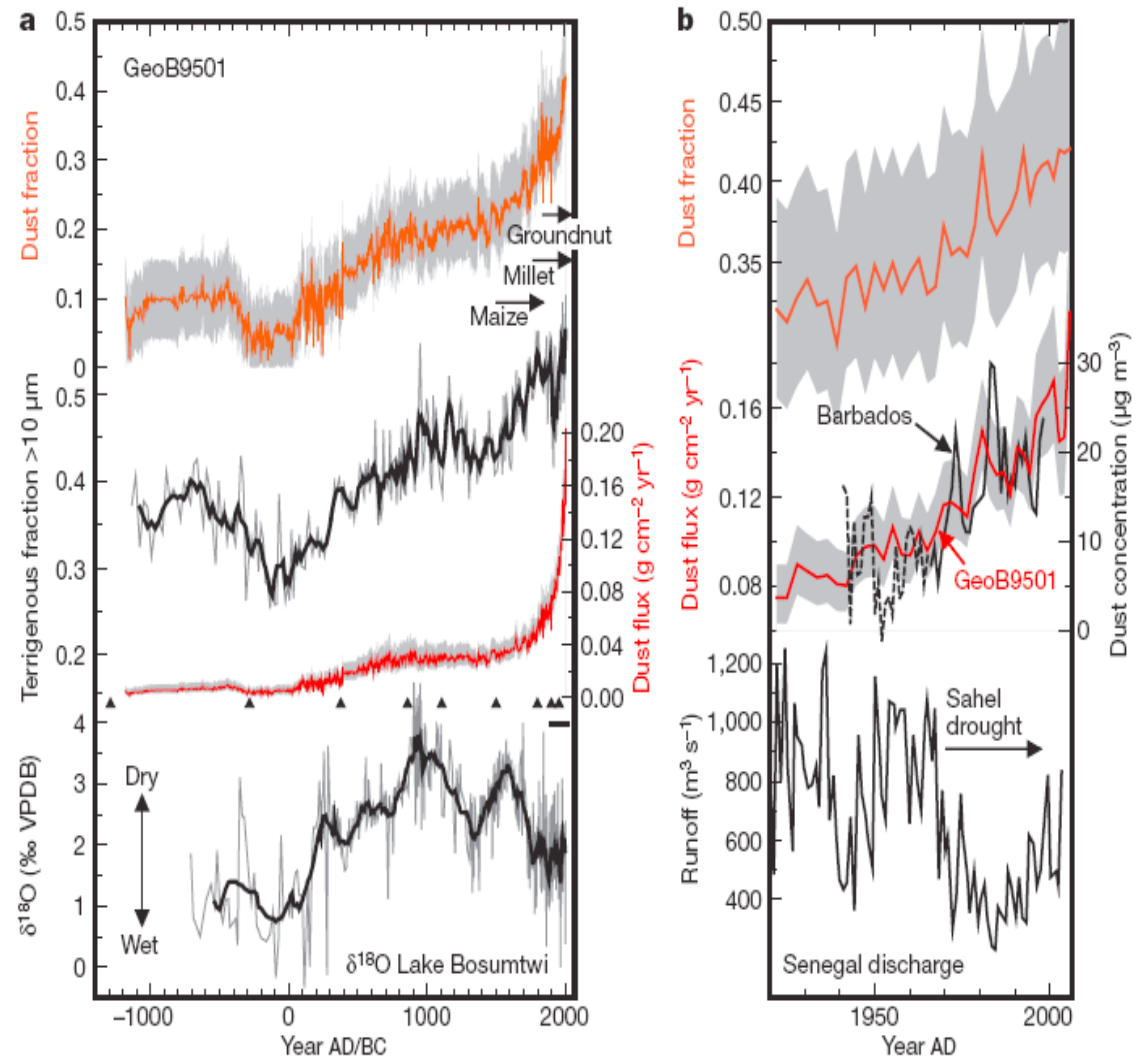


Sahel zone climate change in the late Holocene



Increase in African dust flux at the onset of commercial agriculture in the Sahel region

- Investigation of chemistry and grain size distribution, reconstruction of 3200 year record of dust deposition off NW Africa
- contributions of humans to African dust generation
- Human induced dust emissions started to contribute significantly to the overall dust budget during the onset of commercial agriculture about 200 years ago and have continued ever since



Mulitza, Heslop, Pittauerova, Fischer, Meyer, Stuut, Zabel, Mollenhauer, Collins, Kuhnert & Schulz (2010) *Nature*, 466, 8, 226-228.

Thanks to your attention
and to **pip** for the travelling support

physics international postgraduate